he clearly brings forward his views concerning the union of atoms to form the molecule.

In 1853 he published his interesting observations on the conversion of yellow phosphorus into the red modification by heating it to 200° in presence of mere traces of iodine (*Chem. Soc. Journ.* v. 289). Another very important and difficult investigation which occupied much of his attention about this time was the question of the purification (*Ann. de Chimie*, 45, 351) of graphite, and the determination of its "atomic weight" (*Phil. Trans.* 1859, 249). By heating graphite with strong nitric acid and chlorate of potash, Brodie showed that, unlike all the other modifications of carbon, graphite yields a remarkable crystalline acid, to which he gave the name of graphitic acid, having the formula $C_{11}H_4O_5$. The existence of this interesting body led Brodie to the conclusion that graphite may be considered as a peculiar radical, to which he gave the name of graphon. In the year 1855 Brodie was appointed Waynflete Professor of Chemistry in the University of Oxford, a position which enabled him to throw all his influence into forcing the recognition of chemical science as a proper object of academic training. Under his fostering care the science which had hitherto been so long neglected put out distinct signs of life: new laboratories and lecture-rooms were built, to which students flocked in numbers, and Oxford saw the unwonted sight of her professor of chemistry busily engaged in original investigation, as well as in the tutorial duties of his chair. The discovery of those singular and dangerous bodies, the peroxides of the organic radicals (*Proc.* Roy. Soc. ix. 361, *Phil. Trans.* 1863, 407), was made in the laboratory of the New Museum. The same laboratory soon afterwards saw the minute and careful investigation on ozone (*Phil. Trans.* 1872, 432), which proved beyond doubt or cavil that the supposition that the molecule of ozone is represented by the formula O_3 is both necessary and sufficient to explain all the observed phenomena.

Next we find him experimenting on the synthetic production of the hydrocarbon methane, as well as of formic acid, by the direct union of hydrogen and carbon monoxide under the influence of the electric spark. Then he examines the effect of an induced electric current upon pure and dry carbonic acid, and proves that this gas is partially decomposed with formation of carbon monoxide and oxygen, the latter gas being converted into ozone. And he then proceeds to ask whether the ozone thus produced is identical with that obtained from ordinary oxygen, and by a series of careful quantitative experiments demonstrates the identity of the ozone from these two sources.

This was Brodie's last experimental investigation. Ere long he resigned the Chair of Chemistry at Oxford, regretted by the whole University. He retired to his charming seat on the summit of Box Hill. Neither his own scientific activity nor his deep interest in the scientific work of others ceased on his withdrawal from professional life. Before his retirement he had put forward (*Phil. Trans.* 1866, 781-860) in his "Calculus of Chemical Operations," views altogether novel respecting the nature of chemical change. In place of the usual mode of considering this as due to a change in the relative positions of the atoms of which matter is composed, Brodie founds his theory of the constitution of chemical elements and compounds on the simple volume-relations discovered by Gay-Lussac to exist between these substances in the gaseous state. To hydrogen Brodie gives a simple symbol, because the unit of hydrogen can, as he expresses it, be conceived as made at once by one operation, whilst to oxygen he gives a double symbol, because it cannot, according to him, be made by less than two operations. The element chlorine is supposed to be made up of three operations, and a treble symbol is given to this body. Concerning the probable or possible decomposition of the elements Brodie naturally speculates. His analysis had led him to suspect that "chemical substances are really composed of a primitive system of elemental bodies analogous in their general nature to our present elements, some of which we possess, but of which we possess only a few" ("Ideal Chemistry," p. 54). But no experimental evidence of this fact was offered by him, and none of a satisfactory character was otherwise forthcoming, until Victor Meyer announced his belief that chlorine was capable of undergoing decomposition at high temperatures.

Here was a proof of the truth of Brodie's complex symbol! Sad to say, further experiment has not corroborated this conclusion. No substance differing essentially from chlorine has yet been got from this body. Even the change of density at a white-heat appears in the case of chlorine to be, to say the least, doubtful. So we are left for the present, and the author of the "Calculus of Operations" is left for ever, without the experimental confirmation of his conclusions which he so much desired. Whatever may be the verdict of the future as to the value of Brodie's Calculus, there is no doubt that science is indebted to him for an altogether new view of chemical combination obtained by a systematic analytical process.

This occasion is not a fitting one to enlarge upon the high personal character of the late Sir Benjamin Brodie. Suffice it to say that in all relations in life, in the domestic circle as in society, in the chair at Burlington House as in that at Oxford, he displayed all those qualities of heart and head which alone give dignity and sweetness to life, the possession of which ensures for his memory a lasting place in the minds of all those who were fortunate enough to count him amongst their friends. H. E. R.

THE PHYLLOXERA IN FRANCE

THE new vine-disease, due to the *Phylloxera vastatrix* Planchon, has already caused much damage to the French vineyards and wine-production. From the taxes arising from that national industry France derives a considerable part of her revenue; and this subject has consequently occasioned innumerable publications and investigations. Of the latter some have been empirical and without result; others, which were conducted scientifically, have alone been of any use. It was moreover absolutely necessary to have an unswerving confidence in exact observations, in order to persevere in making experiments which are often disturbed and rendered apparently self-contradictory by the secondary and ever-varying conditions of cultivation. These experiments have at last been crowned with success, and now there are decidedly good grounds for hope. For the last two years the public have shown a steadily increasing confidence in scientific methods.

One of the most distinguished chemists, a man of whom France is proud, and with whom readers of NATURE are well acquainted, especially as they were lately presented with his portrait and biography, M. Dumas, applied himself to the study of the Phylloxera, and pursued his task from day to day with keen determination, notwithstanding the attacks of some and the discouraging advice of others. It is his well-intentioned and unceasing diligence that we must thank for never having lost heart; it is to him that those results are due which are presently to be indicated. When the pébrine-disease was raging on silkworms in the South of France, it was by his personal suggestion and repeated encouragement that M. Pasteur agreed to devote himself to that difficult study; and it is the same gentle influence and guidance that have directed the present writer, together with several others, especially MM. Balbiani, Duclaux, and Mouillefert.

Henceforward the principal problems raised by the study of vine diseases are solved. They were solved one after another in regular order, as fresh light appeared and the ends to be aimed at became more definite. It cannot

be too frequently repeated that that is due, not to a happy hit or to guess-work, but to an unceasing and skilfully conducted struggle which was kept up with indomitable persistence in the midst of obstacles caused by many selfish interests. Times are greatly changed since M. Dumas[1] protested, in discreet but unmistakable language,

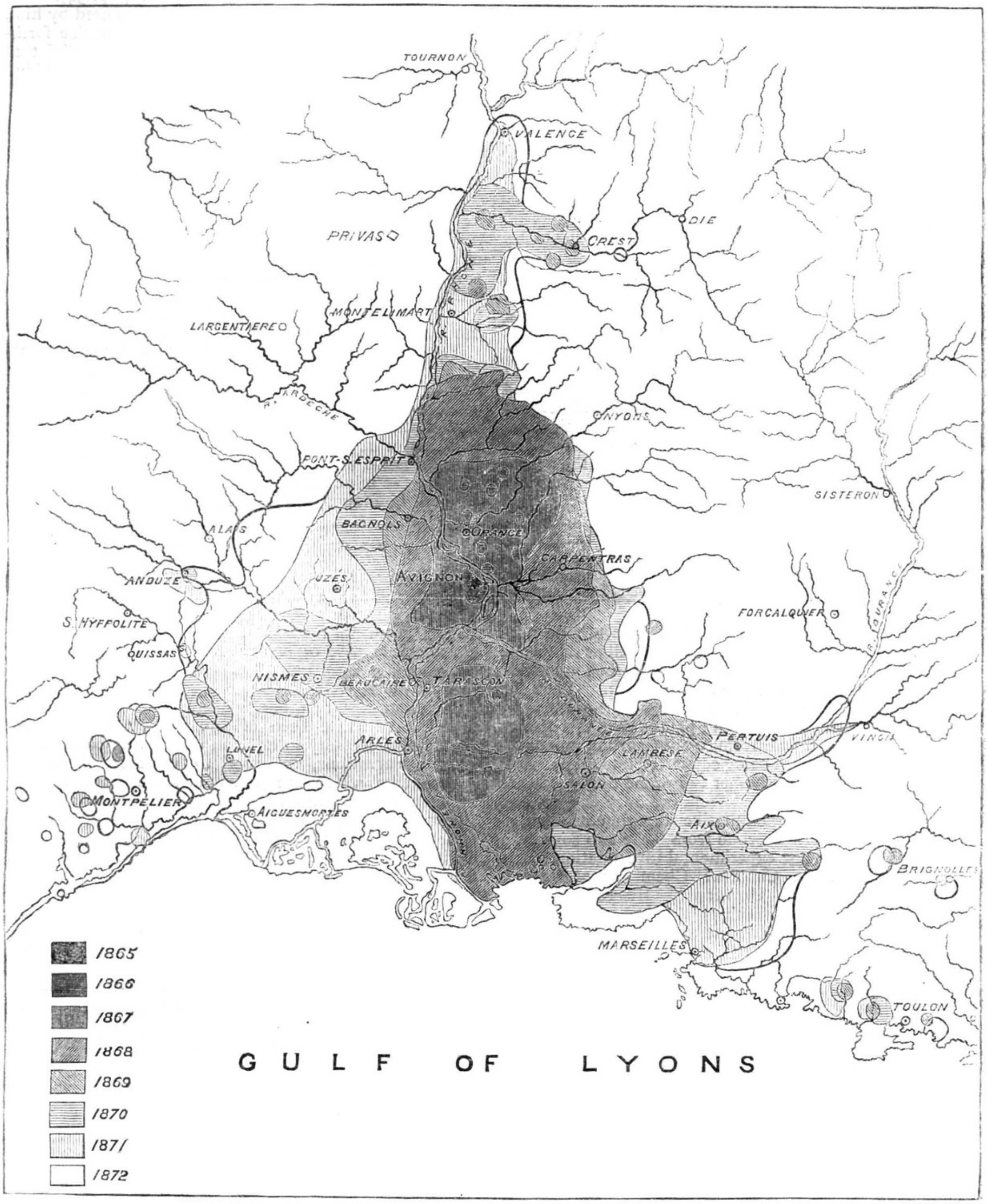

FIG 1.—Map showing the spread of Phylloxera in France from 1865 to 1872. (See NATURE, vol. x. p. 504.)

against the indifference of a French Minister of Agriculture who tried to beat down a grant of 10,000 francs necessary for continuing the scientific investigation. On the same occasion he drew attention to the praiseworthy initiation taken by the railway companies and by various private gentlemen. M. Tirard, the present Minister of Agricul-

[1] Académie des Sciences, February 23, 1874.

ture, has obtained several large grants,[1] and proposes to ask still much larger ones for the approaching campaign, being anxious to assist in every way the laborious struggle. M. Tisserand, the new Director at the Office of Agriculture, a man of great energy and ability, has resolved to back up all his efforts, and has instituted a special central staff to take charge of all documents and operations. The Higher Phylloxera Commission, formed by order of the Minister, has also shown activity: it has adopted a general legislative scheme in order to supply the Government with the arms necessary to defend the threatened territory.

Switzerland and Germany soon adopted similar measures; and with reference to England we must remark that the Phylloxera question may soon become something different from a mere matter of curiosity. Are there no important vineyards in England? We are told that at Liverpool alone, in the "Vineries," there are forty hectares of vines grown under glass. The Phylloxera was observed by Mr. Westwood before it was known in France. It is still found here and there in Ireland, in Scotland, and not far from London itself. By the admirable cultivation under glass, in which English vine-growers are unrivalled, it is kept within narrow limits, but it might

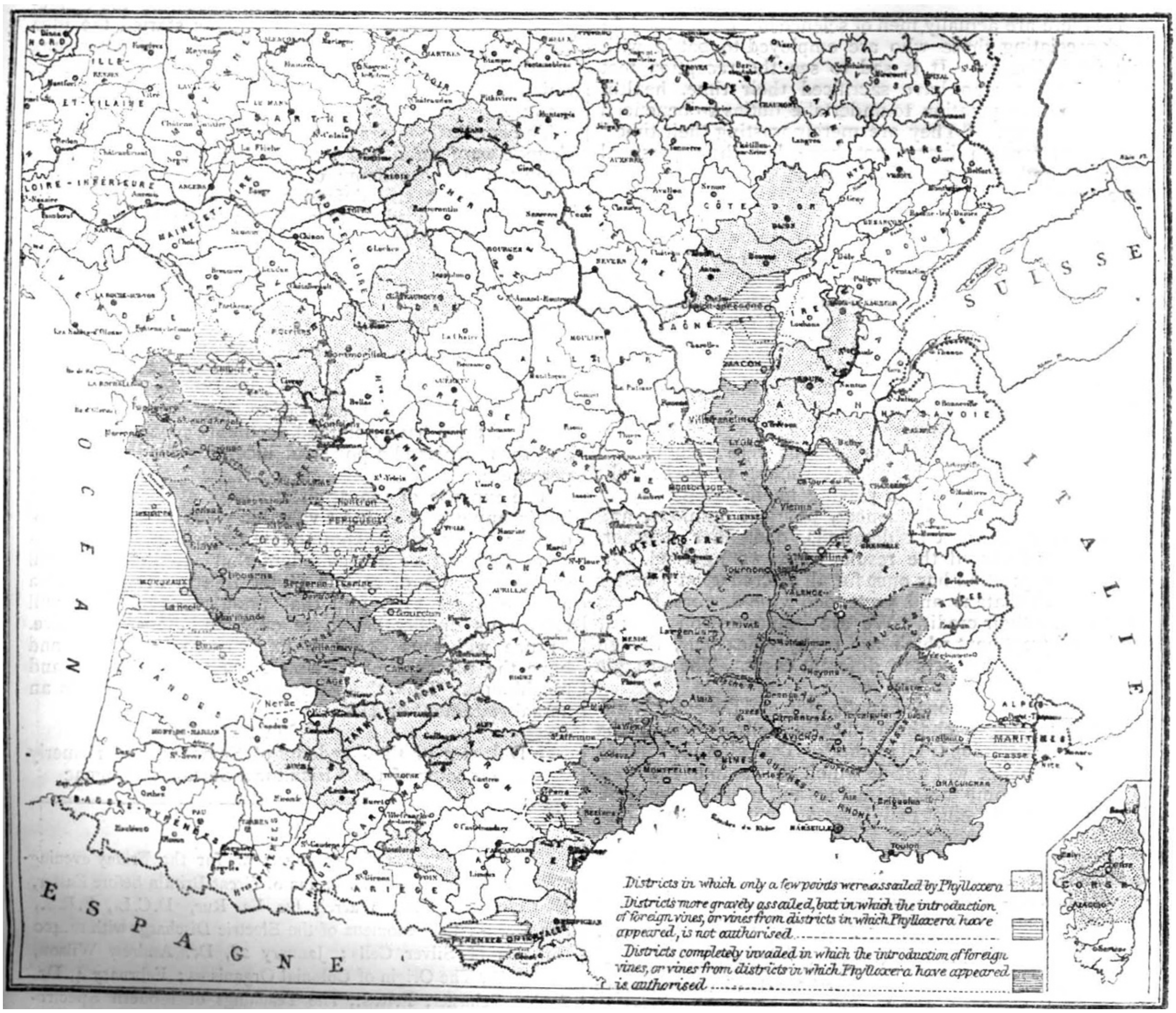

FIG. 2.—Map showing the spread of Phylloxera in France up to 1880.

be communicated to other places. In Switzerland one single parcel of plants is reported to have brought the parasite to Geneva, Schaffhausen, and Neuchâtel. In any case, should an international convention be instituted, the enforced examination at the frontiers would hamper the trade in those magnificent English grapes. The rigorous measures taken against the cattle-disease suffice to show what may be necessary in order to defend the leaf or shoots of the vine.

Extent of the Disease.—The increase of the disease is considerable; thus at the beginning of 1877 there were only twenty-eight departments attacked, whereas at the beginning of 1879, according to the official statistics, there were thirty-nine. Those in the previous year, in order of date,[1] were Loir-et-Cher, Haute-Garonne, Gers, and Corrèze. In 1878 Aude, Pyrénées-Orientales, Haute-Loire, Vienne, Indre, Côte-d'or, and Savoie. In 1879, Haute-Savoie, Jura, Arriège, and Tarn. A special inquiry enables us to determine what area had been invaded in the end of 1879:—the invaded vineyards which had not yet succumbed were 319,760 hectares in

[1] One of 500,000 francs, which has since been doubled.

[1] "Le Phylloxéra, &c.: Rapports publ. par le Ministère de l'Agric." 8 fasc., p. 9. (Paris: Masson, 1879.)

extent, or 76,722 more than the preceding year; the vineyards destroyed, 474,760; or 101,317 more than the preceding year (1878).

There is unfortunately reason to fear that the isolated points may join each other and the affected patches unite. The patches, whether distinct or uniting, increase about 15 kilometres every year; and since the increase in any direction is proportional to the time, the increase of area is as the square of the time. In other words, after 2, 3, 4, 5 years, the evil is increased 4, 9, 16, 25 times. By merely looking at a map showing the extent of the plague, one can form an idea of the invading march of the terrible insect.

Yet there are actually men of science in France who join in depreciating those who are employed to battle with this fatal disease. It is sad to see the reception met with by those who have sacrificed their time, health, and scientific reputation to undertake duties so beneficial to their country. "They are merely wasting their time," say they; "much better not have left their personal duties;" and, true enough, those of whom this is said have cruelly felt its truth. M. Dumas, however, is not one of those.

Several years ago a prize of 300,000 francs was instituted to encourage investigations as to the best remedy against the phylloxera. Much ingenuity was wasted, many absurd remedies proposed, and it is curious to note the substances which were lauded by the inventors. They were for the most part the same, mixed in different proportions—tars, sulphur, lime, soot, urine, phenic acid, and salts of copper or iron. Patient research and scientific study have alone produced certain results.

These results, however, were not accepted and acknowledged without difficulty. Objections were accumulated and many instances of partial failure were brought together, ill-will and inertia playing an important part in the business. Local influences, political opinions, and other extraordinary considerations, one after another, opposed or favoured the results which were gained. At present the question has once for all entered upon a better path, the charlatans and pretended vine-doctors having entirely lost their credit. We are in possession of four modes of treatment which are really efficacious, though they vary in their effects in different cases. The struggle therefore should be maintained.

The various conditions of application and the entirely different principles which the application follows explain the divergence of opinions and methods. The scientific remedy is given: practice will decide which of the four methods is at the same time most efficacious and most economical. This happy result must mainly be attributed to the Commission of the Academy of Sciences, which was presided over by M. Dumas, who was the very soul of it. This Commission sent "delegates," who severally studied special clearly-defined questions, like officers sent by a general to make a reconnaissance in a country.

The commissions instituted in the departments did much good work, especially that of Hérault, which contained several distinguished members, both vine-growers and scientists: MM. Marès and Planchon, Members of the Institute of France; M. Bazille, Senator; M. Vialla, &c. We must also notice particularly the Viticultural Station at Cognac, which was established by private subscription, after the English manner,—a thing of rare occurrence in France. It was M. Lecoq de Boisbaudran, now Member of the Institute, the discoverer of the metal *Gallium*, who first started the idea, and triumphantly realised it in his native town. The principal houses in the trade made it a point of honour to subscribe, and the expenses in four years reached a sum not less than 32,000 francs. It was there that the general experiments as to "insecticides" were made, in accordance with the simple method proposed by M. Cornu, Director of the Viticultural Station, in order to determine definitively what substances are powerless. This work of "clearing the way" necessarily occupied several years, the practical part being energetically carried out by M. Mouillefert, of the National School of Agriculture at Grignon, near Paris, sub-director of the Viticultural Station. Towards the end of the first year they began to distinguish clearly the small group of substances which alone should be utilised. Amongst them was carbon disulphide (CS_2), which had been indicated by Baron Thénard, abandoned and then eagerly resumed by the enthusiastic M. Monestier, and at last rejected in a general manner in the end of 1873 and during 1874.

The carbon disulphide by itself appearing too dangerous to human life, M. Dumas happily started the idea of using it in combination with sulphide of potassium, forming the sulpho-carbonate of potassium ($KSCS_2$), which is both a powerful "insecticide" and an energetic manure.

The conclusions reached by the experiments made at Cognac were published towards the end of 1874 in the Report of the Academy of Sciences (last quarter), and the author can still defend every one of them as they were then deduced, a rare circumstance in connection with the phylloxera.

Under the happy influence of the Minister of Agriculture, the vine-growers were grouped into "vigilance-committees" for watching, and "syndicates" for treating, the vines. Thus the indifference of some and unreasoning excitement of others were followed by energetic preparation for the struggle. At the end of 1878 there were sixty committees instituted in fifty-six departments, and now there are 221, embracing sixty-one departments. Some of them have obtained decidedly successful results, and thus furnished a powerful incentive for the others to persevere.

The expense of the applications is still considerable, but in any case the most valuable vines are now out of danger. The more common vines will at first cost a good deal, but we are confident that scientific skill will supply sulphate of carbon either free or in combination at a cheaper rate, and that practical experience will render its application more easy and less expensive. France will thus continue to produce her wines, and have the pleasure of offering them to her friends and neighbours. This, though apparently a mere wish, is an actual statement of fact.

MAXIME CORNU,
Delegate of the Academy of Sciences, and formerly Director of the Viticultural Station at Cognac

NOTES

THE following are the arrangements for the Friday evening meetings of the Royal Institution of Great Britain before Easter, 1881:—January 21, Warren De La Rue, D.C.L., F.R.S., Sec. R.I., The Phenomena of the Electric Discharge with 14,400 Chloride of Silver Cells; January 28, Dr. Andrew Wilson, F.R.S.E., The Origin of Colonial Organisms; February 4, Dr. Arthur Schuster, F.R.S., The Teachings of Modern Spectroscopy; February 11, Robert S. Ball, LL.D., F.R.S., The Distances of the Stars; February 18, Sir John Lubbock, Bart., M.P., D.C.L., F.R.S., M.R.I., Fruits and Seeds; February 25, Dr. J. S. Burdon-Sanderson, LL.D., F.R.S., Excitability in Plants and Animals; March 4, Sir William Thomson, LL.D., F.R.S., Elasticity viewed as Possibly a Mode of Motion; March 11, uncertain; March 18, Wm. H. Stone, M.D., Musical Pitch and its Determination; March 25, Alexander Buchan, M.A., F.R.S.E., Sec. Met. Soc. Scot., The Weather and Health of London; April 1, uncertain; April 8, Prof. Tyndall, D.C.L., F.R.S., M.R.I.

THERE is nothing that will tend to keep our learned societies in so wholesome a condition as healthy public opinion; it is